Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of Petitions for Rulemaking Regarding the Citizens Broadband Radio Service	GN Docket No. 12-354 RM-11788 RM-11789

REPLY COMMENTS OF GOOGLE INC. AND ALPHABET ACCESS IN RESPONSE TO PETITIONS FOR RULEMAKING

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INTRODUCTION AND SUMMARY

A wide range of parties have filed in this proceeding to describe substantial investments already made in reliance on the Commission's rules, plans to bid on Priority Access Licenses ("PALs") based on existing license size and duration, as well as current and planned infrastructure deployments in the 3.5 GHz band to bring broadband to underserved areas and to realize the promise of 5G networks. The vast majority of these investors oppose the rule changes proposed by CTIA and T-Mobile because they would impede these investments, and explain that (1) substantially larger license areas would drive all but a handful of carriers from PAL auctions and make fixed broadband service using PALs in rural areas impractical; (2) substantially longer license terms would create a barrier to entry for most investors; and (3) removing reliable access to General Authorized Access ("GAA") spectrum would reduce the overall utility of the band and strand investments.

In addition, the record clarifies that the 5G ecosystem is not limited to mobile services offered by telecommunications carriers—it includes a far wider array of innovative access models, applications, standards, and operators than today's wireless networks. Commenters demonstrate that existing CBRS rules will therefore advance U.S. leadership in 5G because they support access to the 3.5 GHz band by the full range of next-generation applications. Conversely, creating rules for the 3.5 GHz band that effectively limit access to PALs to the mobile carrier deployments that characterized older generations of wireless technologies would undermine the transition to robust 5G.

However, the record indicates that the Commission should implement a discrete set of rule changes to ensure the success of the 3.5 GHz band. Because high power commercial weather radars operating adjacent to 3550 MHz have the potential to introduce significant

unwanted emissions into the CBRS band, the Commission should adjust its rules governing operation of these systems to protect the emerging CBRS ecosystem.

I. THE CBRS RULES ARE SUPPORTING SUBSTANTIAL INVESTMENT IN THE 3.5 GHZ BAND AND WIDESPREAD PLANS TO BID IN PAL AUCTIONS.

CTIA and T-Mobile based their petitions on the assertion that the Commission must make fundamental changes to the CBRS rules to support investment and participation in PAL auctions.[1] But the record now demonstrates that this assertion is wrong. The CBRS rules already are supporting large-scale investment across the country and intense interest in the upcoming PAL auctions. The record overwhelmingly confirms that current CBRS rules are attracting the investments needed to deploy networks using a wide range of business models, and plans to participate in PAL auctions by a wide range of broadband providers.

Broadband infrastructure and network investors. The broadband infrastructure and network providers that filed comments supporting the current CBRS rules collectively are serving portions of 36 different states and the U.S. Virgin Islands, and include many companies that, in seeking PALs, would be first-time auction participants.[2] These commenters confirm that

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1 *See* CTIA, Petition for Rulemaking, GN Docket No. 12-354 (filed June 16, 2017) ("CTIA Petition"); T-Mobile USA, Inc., Petition for Rulemaking, GN Docket No. 12-354 (filed June 19, 2017) (T-Mobile Petition").

2 *See, e.g.*, Comments of A Better Wireless, NISP, LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of AirLink Internet Services, GN Docket No. 12-354 (filed July 24, 2017) ("AirLink Comments"); Comments of AlignTec Incorporated, GN Docket No. 12-354 (filed July 24, 2017); Comments of Alluretech, GN Docket No. 12-354 (filed July 24, 2017); Comments of Alsat Wireless, GN Docket No. 12-354 (filed July 18, 2017); Comments of Amarillo Wireless, GN Docket No. 12-354 (filed July 24, 2017); Comments of Arbuckle Communications, LLC, GN Docket No. 12-354 (filed July 21, 2017); Comments of Broadband Corp, GN Docket No. 12-354 (filed July 21, 2017); Comments of Brazos WiFi, GN Docket No. 12-354 (filed July 24, 2017); Comments of Broadband VI, GN Docket No. 12-354 (filed July 19, 2017); Comments of Cardinal Wireless, Tech Guy, Inc, GN Docket No. 12-354 (filed July 24, 2017); Comments of Celerity Networks LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of Columbia Energy LLC, GN Docket No. 12-354

their interest, investments, and planned deployments in the 3.5 GHz band depend on maintaining the CBRS operating rules the Commission adopted two years ago. Supporters of today's CBRS rules include Southern Linc, which provides mobile wireless services in Georgia, Alabama, Mississippi, and Florida that are "used by local and statewide public safety agencies, school

(filed July 20, 2017); Comments of County of Bland, Virginia, GN Docket No. 12-354 (filed July 24, 2017) ("Bland County Comments"); Comments of Eastern Carolina Broadband, LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of EBTX Wireless, LLC, GN Docket No. 12-354 (filed July 21, 2017) ("EBTX Comments"); E-vergent.com, LLC Comment, GN Docket No. 12-354 (filed July 21, 2017) ("E-vergent.com Comments"); Comments of Excel.Net, GN Docket No. 12-354 (filed July 24, 2017); Comments of FastNet Wireless LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of Fire2Wire, GN Docket No. 12-354 (filed July 24, 2017); Forethought.net Comment, GN Docket No. 12-354 (filed July 24, 2017); Comments of In the Stix Broadband, LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of KWISP Internet, GN Docket No. 12-354 (filed July 24, 2017) ("KWISP Comments"); Comments of LTD Broadband, GN Docket No. 12-354 (filed July 24, 2017) ("LTD Broadband Comments"); Comments of MetaLINK Technologies, GN Docket No. 12-354 (filed July 24, 2017); Comments of New Lisbon Broadband and Communications (NLBC), GN Docket No. 12-354 (filed July 21, 2017) ("New Lisbon Comments"); Comments of Northern Skies Wireless, GN Docket No. 12-354 (filed July 24, 2017) ("Northern Skies Comments"); Northwest Communications Comments, GN Docket No. 12-354 (filed July 21, 2017); Comments of PEAK Internet, GN Docket No. 12-354 (filed July 21, 2017); Comments of Rapid Systems, GN Docket No. 12-354 (filed July 21, 2017) ("Rapid Systems Comments"); Comments of REACH4 Communications, GN Docket No. 12-354 (filed July 18, 2017) ("REACH4 Comments"); Comments of RF Design Services, LLC, (filed July 18, 2017); Comments of SmartBurst LLC, GN Docket No. 12-354 (filed July 24, 2017) ("SmartBurst Comments"); Comments of Southern Linc, GN Docket No. 12-354 (filed July 24, 2017); Comments of SPITwSPOTS, Inc., GN Docket No. 12-354 (filed July 24, 2017) ("SPITwSPOTS Comments"); Comments of Starry, Inc., GN Docket No. 12-354 (filed July 24, 2017) ("Starry, Inc. Comments"); Comments of the City of New York, GN Docket No. 12-354 (filed July 24, 2017) ("City of New York Comments"); Comments of the Wireless Internet Service Providers Association, GN Docket No. 12-354 (filed July 24, 2017) ("WISPA Comments"); Comments of TREPIC Networks LLC, GN Docket No. 12-354 (filed July 24, 2017); Comments of Valnet Holdings, LLC, GN Docket No. 12-354 (filed July 21, 2017); Comments of Virginia Everywhere, LLC dba All Points Broadband, GN Docket No. 12-354 (filed July 21, 2017) ("All Points Comments"); Comments of West Michigan Wireless ISP, GN Docket No. 12-354 (filed July 24, 2017) ("West Michigan Wireless Comments"); Comments of Wireless Etc., GN Docket No. 12-354 (filed July 24, 2017); Comments of Wispwest.net, GN Docket No. 12-354 (filed July 24, 2017).

districts, rural local governments, public utilities, and other emergency responders," as well as "other commercial entities in both urban and rural areas."[3] As Southern Linc explains, "the regulatory flexibility and adaptability adopted by the Commission for the CBRS band provides Southern Linc . . . with the opportunity to develop, implement, and deploy innovative services and network configurations supporting a wide variety of potential use cases—both commercial and private . . . ."[4]

NCTA notes that the 3.5 GHz band has also "drawn significant attention and investment" by members of the cable industry, including Charter, Comcast, and CableLabs.[5] Two associations of rural service providers, the Rural Wireless Association and NTCA—The Rural Broadband Association, similarly explain in joint comments that "small and rural telecommunications and broadband providers throughout the country . . . have invested resources toward new and innovative deployments [in the 3.5 GHz band] while relying upon a predictable regulatory framework."[6]

Many broadband providers that support today's CBRS rules specifically state that they expect to bid for PAL licenses to serve consumers in their local areas. For example, EBTX Wireless is a broadband provider in Wharton and Fort Bend Counties, Texas, that serves consumers who often have no other terrestrial broadband options.[7] EBTX has made significant investments in 3.65 GHz equipment "with hopes of being able to participate in the auction for

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3 Southern Linc Comments at 2.

4 *Id.* at 2-3.

5 NCTA – The Internet & Television Association Comments on Petitions for Rulemaking at 4-5, GN Docket No. 12-354 (filed July 24, 2017) ("NCTA Comments").

6 *See* Comments of the Rural Wireless Association and NTCA—The Rural Broadband Association at 3, GN Docket No. 12-354 (filed July 24, 2017) ("RWA Comments").

7 EBTX Comments at 1.

spectrum that was proposed for the CBRS band."[8] As EBTX explained, maintaining the existing PAL license areas "will help [EBTX] continue to improve our current coverage and allow us the opportunity to invest to better penetrate our rural areas with great, reliable, high speed internet due to the reduction in congestion and interference in the proposed spectrum."[9]

New Lisbon Broadband and Communications, a full-service communications provider in East Central Indiana, first began operating 116 years ago to bring voice service "to areas no other provider wished to."[10] Today, New Lisbon seeks to use a mix of technologies to bring broadband to customers in isolated areas—including areas that "large Cellular companies will [not] ever consider" serving.[11] New Lisbon has "invested in and tested extensively" in the 3.65 GHz band, and is "very excited" about accessing CBRS spectrum and the Commission's moving forward with PAL auctions "so that we can purchase some PALs in our area."[12] According to New Lisbon, however, the potential for the CTIA and T-Mobile petitions to cause the Commission to change its "original plan" for the CBRS band has forced them "to slow our [3 GHz] deployments until decisions are finalized."[13]

All Points Broadband is a communications provider that serves portions of rural Maryland, Virginia, and West Virginia, including areas where there are no other terrestrial broadband options.[14] All Points describes itself as "an example of the private sector's

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8 *Id.*

9 *Id.* at 2-3.

10 New Lisbon Comments at 1.

11 *Id.*

12 *Id.*

13 *Id.*

14 All Points Comments at 1.

willingness to invest in rural broadband [when] there is a sensible regulatory environment that encourages investment."[15] All Points has "purchased equipment and [is] making significant investments to prepare [its] network for CBRS deployments," relying on the regulatory framework the Commission has established.[16] All Points "plan[s] to bid on Priority Access Licenses (PALs) and [has] engaged advisors to assist [it] in this process."[17] However, "if the CBRS licensing regime is based on larger geographic areas such as Partial Economic Areas (PEAs), [it] will not be able to justify the investment required to provide last-mile service" to unserved areas.[18]

KWISP Internet also opposes the CTIA and T-Mobile petitions. For 15 years, KWISP has provided communications services in LaSalle and DeKalb Counties, Illinois.[19] KWISP serves areas with low population density—where residences are often separated by half a mile.[20] Most of KWISP's current customers reside in 11 census tracts.[21] KWISP noted that, while it will "definitely bid on PALs in those census tracts, plus some adjacent tracts," it would likely be priced out of a PAL auction based on PEAs, and would not have the ability to provide service to an entire PEA even if it were to win a PEA-based PAL auction.[22]

Equipment manufacturers and systems integrators. Companies that will provide devices and other equipment for CBRS operations and/or configure and deploy CBRS networks

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15 *Id.*

16 *Id.*

17 *Id.*

18 *Id.* at 2.

19 KWISP Comments at 1.

20 *Id.*

21 *Id.*

22 *Id.* at 2.

are likewise investing in the 3.5 GHz band based on opportunities created by the current rules. For example, network infrastructure equipment manufacturer Ruckus Wireless, which is the largest vendor of service-provider Wi-Fi systems, opposes the CTIA and T-Mobile petitions and emphasizes the "huge amounts of time, money, and resources that industry has invested in operationalizing the current CBRS framework."[23] Communications equipment and infrastructure provider Motorola Solutions Inc. likewise "strong[ly] support[s]" the current CBRS rules.[24] As Motorola Solutions explains, "a variety of industrial and enterprise sectors such as oil & gas companies, utilities and other critical infrastructure entities, industrial and manufacturing, mining, hospitality, and others" are likely to benefit from deployments using the existing framework.[25]

Similarly, Casa Systems, a network solutions developer whose portfolio includes "mobile edge computing, licensed small cells, transport security and Wi-Fi," observed that its "customers are showing significant interest in both 5G applications and the CBRS band."[26] In particular, Casa's customers are interested in applications involving private networks, augmenting existing carrier network capacity, mobile virtual network operations, neutral host networks that can support multiple carriers, and fixed wireless deployments.[27] Casa notes that "the Commission's current rules do a good job of enabling both traditional and non-traditional operators to gain

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[23] Comments of Ruckus at 9, 11, GN Docket No. 12-354 (filed July 24, 2017) ("Ruckus Comments").

[24] Comments of Motorola Solutions Inc. in Response to Petitions for Rulemaking at 1-2, GN Docket No. 12-354 (filed July 24, 2017).

[25] *Id.* at 2.

[26] Comments of Casa Systems at 9-10, GN Docket No. 12-354 (filed July 24, 2017) ("Casa Systems Comments").

[27] *Id.* at 10.

access to the [3.5 GHz band]," and that it "hopes to continue to develop products that would be suited for" a wide range of CBRS applications.[28]

LTE equipment manufacturer Baicells Technologies also emphasizes the substantial 3.5 GHz band investments made by manufacturers based on the current CBRS rules.[29] In fact, Baicells has launched a North American subsidiary to serve the emerging CBRS market, noting that it expects to receive $100 million in revenues "just to our company in [CBRS] products and services within the 2nd full year of the band's opening."[30] As Baicells explains, "[w]ith 74k census tracts and up to 7 PALs per tract, even the smallest of school systems, the most budget constrained small town, a single hospital system, and yes, a rural wireless broadband service provider . . . has a fair shot to obtain a PAL."[31]

SAS administrators. Other entities that have received conditional certification as Spectrum Access System ("SAS") administrators similarly have contributed significant time, effort, and expense to help enable commercial 3.5 GHz deployments in the near term (just as Google has). For example, Sony Corporation "has devoted time and manpower" to serve as a SAS administrator for wireless operations in the CBRS band, and did so "based on the expectation that the Commission would remain committed to rules that it put in place over two years ago and reaffirmed just last year."[32] And Federated Wireless confirms that "[f]ollowing the adoption of the *3.5 GHz Order*, industry interest in, and momentum toward, the dense,

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28 *Id.* at 11.

29 See Comments of Baicells Technologies North America, Inc., GN Docket No. 12-354 at 1 (filed July 20, 2017) ("Baicells Comments").

30 *Id.*

31 *Id.* at 2.

32 Comments of Sony Electronics, Inc. at 1 n.1, GN. Docket No. 12-354 (filed July 21, 2017).

widespread commercial use of the CBRS spectrum has continued to grow at a tremendous rate."[33] Because the current regulatory framework has created "widespread momentum throughout all sectors of the CBRS ecosystem," CBRS operations are "ready to launch as soon as SAS certification is complete."[34]

II. THE CHANGES PROPOSED BY CTIA AND T-MOBILE WOULD UNDERMINE RATHER THAN PROMOTE INVESTMENT.

Beyond demonstrating that investment and innovation in the 3.5 GHz band is well underway, the record shows that the changes to the CBRS framework proposed by CTIA and T-Mobile would undermine rather than advance deployment overall. Commenters explain that the dramatic increases in the geographic size and temporal duration of PAL licenses sought by the Petitioners would drastically alter the economics of PAL operations, excluding most smaller operators—including many that have already begun to invest in reliance on the existing rules. Likewise, undermining the GAA tier, as T-Mobile alone has proposed, would increase risk for all CBRS operators, and upset the settled expectations of existing Part 90 Subpart Z licensees in the 3650-3700 MHz band.

A. PEA-sized license areas likely would drive all but a handful of carriers from the auction.

Broadband providers across the country filed comments demonstrating why Petitioners' proposal to expand PAL license areas to PEAs will harm investment in the 3.5 GHz band. As Southern Linc explains, PEAs are "much too large for the service needs of the vast majority of potential users of the CBRS band, such as rural broadband service providers, private network

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[33] Comments of Federated Wireless, Inc. at 3, GN Docket No. 12-354 (filed July 24, 2017) ("Federated Wireless Comments") (internal citation omitted).

[34] *Id.* at 4.

operators, municipalities and state and local government agencies, commercial venues (such as stadiums, arenas, and shopping malls), educational institutions, and so forth."[35] If PALs were expanded to cover entire PEAs, "an entity seeking to operate in a limited geographic area such as a single county or across a few census tracts would be compelled to submit the highest bid for the entire PEA."[36] This would almost certainly cause prices for the auctioned blocks—though not total auction revenue—"to skyrocket and would freeze out many small and rural providers and particularly new entrants from the auction process."[37]

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[35] Southern Linc Comments at 7.

[36] City of New York Comments at 1-2.

[37] RWA Comments at 5. *See also* Comments of AirFi, Inc. at 1, GN Docket No. 12-354 (filed July 24, 2017)("[A] change like this would be a death sentence for any/all future WISP funding. In their eyes, we'd be sinking fast in a losing battle"); Baicells Comments at 2-3 ("Change [PAL license areas] to a geographic unit much larger, say one with 410 tracts, and extend the license term to 10 years and the cost of PALs becomes prohibitive, and even pointless since the geographic coverage will far exceed the limited area many small entities (like a school system, town, utility, etc.) will need."); West Michigan Wireless Comments at 1 ("Allowing the mobile carriers to 'take over' this band will lock the smaller providers out"); Northern Skies Comments at 1 ("[Larger license areas] will rig the game in [large carriers'] favor and make small operators like me unable to compete."); E-vergent.com Comments at 1 ("The PEA's are too large for many other potential users such as school districts, water utilities, local governments, and even private enterprise much less service providers such as e-vergent."); REACH4 Comments at 1 ("REACH4 Communications does not have the means or funds to bid on Partial Economic Areas (PEAs) to secure spectrum"); SmartBurst Comments at 1-2 ("Smaller providers like SmartBurst, even if they had the means to outbid the large carriers, would be forced to acquire large-area licenses (multiple counties) that are likely much larger than the targeted areas SmartBurst and other WISPs would want to serve."); KWISP Comments at 2 ("If PALs are instead based on PEAs, the bid price will likely exceed what a WISP can afford."); AirLink Comments at 1 ("If the FCC adopted their proposals, AirLink and many other wireless internet providers would not be able to use the GAA spectrum and would be severely limited in bidding for PAL spectrum against the deep pockets of T- Mobile"); WISPA Comments at20-21 (""[R]equiring PALs to be auctioned by PEAs will exponentially increase the geographic area and population of auctioned spectrum, dramatically increase the cost of PALs, and assuredly foreclose participation by smaller providers that have a desire to serve smaller areas and lack the ability to bid against T-Mobile and its multi-billion dollar mobile wireless competitors for areas that far exceed the size of smaller, targeted areas.").

The effect on rural providers would be especially severe. Rural providers stress that, with larger license areas, rural areas are more likely to be combined with urban markets in a single PEA.[38] Rural providers would therefore have to bid for license areas that include residents and territory far outside their service areas, and bid against large carriers that seek primarily to serve densely populated areas. As a result, the rural operators must bid for more area than they will serve, expand out of their core markets to become urban providers, or lose the opportunity for licensed spectrum in the 3.5 GHz band.

A number of would-be PAL licensees have already made significant investments premised on the opportunities presented by the existing PAL license areas. As Bland County, Virginia, observes, the geographic size of PALs under the existing rules is the "main reason" for many companies' existing investments in the band, because it is the only way they will be able to

[38] *See, e.g.*, Comments of Vivint Wireless at 5, GN Docket No. 12-354 (filed July 24, 2017) ("the major obstacle with PAL service areas being auctioned on a PEA basis is the combination of dense urban, urban, suburban and rural areas into a single license. For example, the entire bay area in Northern California is one PEA (PEA004), and Southern California has only two PEAs covering the entire Los Angeles and San Diego areas (PEA002 and PEA0018). Any PAL auction on PEA basis will likely reduce spectrum utilization because only one operator will win per PEA market, which will likely be a cellular carrier with deeper pockets to spend on spectrum acquisition particularly in dense urban markets, but such winner may not deploy to the entire PEA. By retaining census tract service areas for PALs, multiple types of providers will have an opportunity to obtain spectrum and are more likely increase spectrum utilization by acquiring spectrum in those specific geographic areas they intend to serve.") (internal citations omitted);LTD Broadband Comments at 1 ("If the FCC allows the large mobile carriers to bid on very large geographies - they will bid high to go after the high density markets they want and price-out small rural-focused competitors like LTD Broadband."); KWISP Comments at 2 ("KWISP's service area is essentially 11 census tracts. We would definitely bid on PALs in those census tracts, plus some adjacent tracts. We already use this spectrum to serve customers, so we would not be warehousing spectrum. If PALs are instead based on PEAs, the bid price will likely exceed what a WISP can afford. Even if we could compete in the auction, we would certainly end up serving only part of a PEA, especially those that contain more densely populated areas along with rural areas."); Southern Linc Comments at 7 ("Under the petitioners' approach, an entity seeking to operate in a limited geographic area such as a single county or across a few census tracts would be compelled to submit the highest bid for the entire PEA.").

actually afford spectrum.[39] Thus, a significant enlargement of PAL license areas would not only limit future investments to large carriers, it would also strand investments already made in reliance on the existing rules by small providers that can ill afford to waste such substantial investments due to unexpected regulatory changes.[40]

Petitioners support their request that the FCC change course and undermine existing investment with a collection of claims that other commenters have already refuted.[41] For example, Petitioners argue that smaller license areas will create complexities in administering the auction and managing interference between PALs, preventing investment. The record demonstrates that this assumption is incorrect. As Google has already explained, there is no sound reason to believe that the number of PALs will raise special interference management challenges. SASs manage interference on a highly granular, per-device basis regardless of the

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[39] Bland County Comments at 1. *See also* SPITwSPOTS Comments at 1 ("The combination of relatively short license terms, innovative frequency coordination and highly local license areas (census tracts) could afford great opportunities to small provider and new competition in these bands"); Baicells Comments at 2 ("[I]t's the ability to purchase LOW COST [PALs] that make this all work so small entities can operate their private networks in a protected manner. And, that is ONLY possible if the geographic scope of a license remains by census tract.").

[40] *See, e.g.,* All Points Comments at 1 ("We raised private, at-risk capital from institutions and individuals which we deploy to bring broadband service to areas where there are no terrestrial alternatives or a lack of choice. Our young, entrepreneurial company is an example of the private sector's willingness to invest in rural broadband if there is a sensible regulatory environment that encourages investment."); Baicells Comments at 3 ("[C]ountless groups have been operating in good faith across every conceivable sector building mechanisms, business models, and technologies under the CURRENT rules, working together in the best of American entrepreneurial spirit to bring next generation benefits to our fellow citizens. Please don't destroy that spirit and potential simply to placate the whines of a few companies.").

[41] *See* Comments of Google Inc. and Alphabet Access in Response to Petitions for Rulemaking at 24-26, GN Docket No. 12-354 (filed July 24, 2017) ("Google Inc./Alphabet Access Comments"); Comments of the Dynamic Spectrum Alliance at 10, GN Docket No. 12-354 (filed July 24, 2017) ("DSA Comments").

PAL size.[42] Likewise, modern data management systems are fully capable of handling the number of PAL auctions required to support smaller PALs.[43] In addition, however, the record now demonstrates empirically that these considerations will not deter investment: broadband providers have already made significant investments despite Petitioners' claims, and confirm that they will bid in the PAL auctions.[44] Petitioners also fail to substantiate their claims that any additional administrative complexity experienced by large national carriers because of smaller license areas outweighs the benefit of allowing smaller, local companies economically feasible access to PALs. As KWISP Wireless explains, if the Commission were to accept the Petitioners' argument, "[small competitors] would be effectively shut out of the PAL bidding, just so big companies don't have to submit as many bids."[45] Such a decision would be contrary to the Commission's goals of expanding access to broadband Internet in rural areas, and would also undermine its goal of promoting efficient use of spectrum.

Excluding small operators from meaningful participation in PAL auctions would also diminish overall investment in the band. Spectrum auctions promote investment by providing an efficient means of assigning spectral resources to the entities that value them the most highly—generally speaking, the company that values spectrum the most highly will be the one that is both most likely to win the auction, and to make robust investments in deploying service. But barring small operators from the auction by increasing license size reduces the overall efficiency of the auction[46] and raises the possibility that the bidder excluded from the auction might have been the

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42 *See* Google Inc./Alphabet Access Comments at 25-26.

43 *See id.* at 25.

44 *See generally* Section I *supra*.

45 KWISP Comments at 2.

46 William Lehr and J. Armand Mosey, *Right-Sizing Spectrum Auction Licenses: The Case for Smaller Geographic License Areas in the TV Broadcast Incentive Auction,* 37 HASTINGS

user that valued the resource the most. For example, the record makes clear that if PALs are expanded to cover entire PEAs, many rural broadband providers will be unable to meaningfully participate in the PAL auction, even though it may only seek to serve a rural portion of the PEA where a large carrier would have invested little. Conversely, however, nothing would stop a large carrier from acquiring all the PAL licenses they need under the existing rules.

The record also confirms that the ability for a carrier to partition its PAL license through the secondary market is not a substitute for license areas that are properly matched to the diversity of business models and technologies that will seek access to PALs. As Southern Linc points out, the large carriers will be under no obligation to make their surplus spectrum available on the secondary market.[47] And if history is any guide, they will rarely transfer their spectrum to smaller competitors. For example, in the Commission's proceeding examining AWS license assignments from SpectrumCo to Verizon, rural providers emphasized "the difficulty that competitive carriers face with respect to obtaining useable, 4G-ready spectrum on the secondary market," even when large amounts of licensed spectrum are unused.[48] Larger licenses areas, with or without associated build-out requirements, would be undesirable for all potential CBRS participants, other than a few large carriers[49]—and in the absence of rigorous build-out

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COMM. & ENT. L.J. 231, 248 (2015) ("Economists generally believe greater participation in auctions enhances auction efficiency").

47 Southern Linc Comments at 7-8.

48 Letter from Michael Lazarus and Andrew Morentz, Counsel to RCA, Telecommunications Law Professionals PLLC, to Marlene H. Dortch, Secretary, Federal Communications Commission, at 2, WT Docket No. 12-4 (filed July 11, 2012).

49 *See supra* note 37.

requirements, large carriers will have even less incentive to make unused spectrum available to other operators.[50]

Economic research confirms that even with the ability to partition, oversized license areas decrease efficiency and may depress auction proceeds. If license areas are too big, prospective bidders tend to "lower their bids to compensate for the inefficiently high capital costs, and build out expenses and regulatory costs associated with buying and holding the surplus spectrum assets."[51] In other words, when license areas are too large, they may become less valuable at auction per unit (*e.g.*, MHz/POPs or MHz/km^2), even if the total cost of a license is much higher due to its larger geographic area. At the same time, when local businesses and broadband providers are compelled to bid on more spectrum than they need, the increased total cost of a license may cause them never to participate in the auction in the first place, reducing the efficiency of the auction by reducing the number of participants.[52] Barring smaller bidders from meaningfully participating in PAL auctions would also harm consumers.

> [T]he failure to assign spectrum efficiently will harm the consumers where the spectrum is less likely to be built out. This effect will reduce their choices and ultimately create an artificial spectrum scarcity as other operators may have been willing to bid for a build-out of that area if it had been available in a small, targeted area.
>
> The added costs and time associated with re-assigning the spectrum via secondary markets or subleases will, as the following paragraphs explain, distort investment in complementary assets, such as radio network infrastructure. It will also increase the cost and delay the delivery of broadband to underserved communities.[53]

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50 *See* Southern Linc Comments at 7-8.

51 *Right-Sizing Spectrum Auction Licenses* at 248.

52 *Supra* note 46.

53 *Id.* at 250.

Thus, even assuming that PAL licensees would make their surplus spectrum available on the secondary market, the delay and costs of these transactions would themselves undermine wireless investment.

B. Ten-year license terms with a renewal expectation would serve as a barrier to entry for all but a few large carriers.

The record demonstrates that lengthening PAL license terms beyond the current 3-or 6-year periods would undermine investment in the band and limit operators' ability to bid for PALs to serve rural and other underserved areas. Contrary to Petitioners' claims, broadband providers across the country state that extending PAL license terms to 10 years with an expectancy of renewal would create license terms far longer than necessary for carriers to recoup their construction investments, again resulting in license costs so high that they bar smaller operators from bidding on and winning PALs. Indeed, the record is dominated by companies—including T-Mobile[54] and other CTIA members themselves[55]—that have already begun to invest in CBRS technology under the existing rules with existing license terms.

The record also reveals a curious disconnect between the views of the largest carriers and those of local broadband Internet providers. While the former insist that they require effectively perpetual licenses to recoup their investments, the latter apparently do not require—and, in fact, oppose—any such guarantees in order to invest. Dozens of rural broadband providers, serving dozens of states, have filed comments in this proceeding objecting to the large carriers' proposals.[56]

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54 *See T-Mobile USA, Inc. Request for Part 5 Experimental License*, ELS File No. 0230-EX-CN-2017 (filed April 4, 2017).

55 *See* Google Inc./Alphabet Access Comments at 5-10.

56 *See supra* note 2.

What perpetual license terms clearly *would* do, however, is increase the cost of PALs at auction and prevent many potential users from acquiring licenses. As Southern Linc explains, "any extension of the license term for PALs will concurrently make the cost of obtaining PALs that much more expensive and could drive the cost of PALs beyond what many of the potential users of the CBRS band, such as smaller commercial entities and private network operators, could afford."[57]

In addition to driving up costs, long license terms would increase the uncertainty associated with their true value. Although an operator may have concrete plans and, thus, a reliable valuation model for a PAL over the next three years, few if any will be able to predict how this spectrum will most productively be used ten years hence, or beyond. This is especially true of 5G deployment, which will comprise a heterogeneous mix of both spectrum uses and innovative new technologies, many of which are still being developed. A large carrier may be able to raise the capital and tolerate the risk necessary to acquire such an asset. But smaller operators, like local broadband providers, educational institutions, venue operators, and other private network operators likely will not.

Unnecessarily long license terms would also "lead to slower buildouts and more dead zones."[58] A ten year license (to say nothing of an effectively perpetual license) would allow carriers to deploy service at a leisurely pace which, while it may pose fewer logistical challenges for carriers, would harm consumers by delaying access to broadband Internet or other CBRS-based services. Adopting Petitioners' proposal to extend the license term without also imposing a build-out requirement would only compound this problem. A shorter license term, however,

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[57] Southern Linc Comments at 6.

[58] City of New York Comments at 2.

would encourage operators to deploy rapidly in order to recoup their investment and earn profits before the license expires. Shorter license terms therefore would benefit consumers both by expanding use of PALs beyond the large carriers and making it more likely that PAL licensees build out their licenses expeditiously.

C. Undermining or eliminating GAA would undermine infrastructure deployment, reduce the overall utility of the band, and strand investments WISPs have already made.

T-Mobile would have the Commission make GAA spectrum available only "on an opportunistic basis"[59]—i.e., only at times and places where a PAL licensee is not operating on a particular channel. But there are likely to be few, if any, such areas in urban cores, and even in less densely populated areas T-Mobile's proposal would make it impossible for an operator to have a reasonable expectation that GAA spectrum would be available from one year to the next. This uncertainty and lack of urban access would, as Federated Wireless described, "eviscerate the GAA tier."[60]

Access to GAA spectrum, however, is essential to wireless Internet service providers and other types of local companies with smaller budgets and who might never choose to bid on PALs. For these GAA-only operators, access to GAA spectrum is essential.[61] And even in rural areas where GAA spectrum might be plentiful today, the possibility that GAA spectrum could be eliminated as the result of a future PAL auction would make it far more difficult to justify the investments needed to bring new service to rural areas. In essence, T-Mobile's proposal would

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[59] Comments of T-Mobile USA, Inc. at 4, GN Docket No. 12-354 (filed July 24, 2017).

[60] Federated Wireless Comments at 5.

[61] *See, e.g.,* Rapid Systems Comments at 1.

put GAA-only operators entirely at the mercy of their well-funded competitors, who could cut off all access to GAA spectrum just by submitting bids for all the available PALs in a market.

Allowing PAL use of 3650-3700 MHz would also create new challenges for accommodating grandfathered wireless licensees currently authorized under Part 90 Subpart Z. As several commenters pointed out,[62] making PALs available in these 50 MHz would undermine the expectations of existing licensees in that band—many of which are rural broadband Internet providers—by eliminating the expectation that they will continue to be able to operate in their existing spectrum on a GAA basis. Under T-Mobile's proposal, these operators would be required to transition to GAA spectrum under the existing rules, only to have this spectrum taken away from them when a large carrier decides to reserve it for a PAL.[63] The Commission has already specifically, and correctly, determined that, unlike PALs, "GAA operation closely aligns with the current licensing regime in the band where licenses are awarded on a non-exclusive

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[62] Comments of the Enterprise Wireless Alliance at 2, GN Docket No. 12-354 (filed July 24, 2017); Comments of Charter Communications, Inc. at 4-5, GN Docket No. 12-354 (filed July 24, 2017); KWISP Comments at 2; NCTA Comments at 14.

[63] *See, e.g.,* All Points Comments at 2 ("We are very concerned about T-Mobile's proposal to convert the entire 150 MHz band to PALs, which would eliminate GAA channels and allow only opportunistic GAA use. Under current rules, the Grandfathered Wireless Protection Zones in the 3650-3700 MHz band will become GAA after the transition ends in April 2020. The FCC wisely acknowledged the potential for damaging interference and stranded investment when it adopted the grandfathering rules and procedures in 2015. It should not now change its mind just so three large mobile wireless carriers can someday, maybe, deploy 5G, whenever that standard is actually adopted."); REACH4 Comments at 1 ("Granting CTIA's and T-Mobile's petitions will effectively shut us down, especially if the 3650-3700Mhz band is auctioned off."); WISPA Comments at 14 ("eliminating the GAA spectrum allocation in the 3550-3650 MHz band and allowing PALs into the 3650-3700 MHz band will introduce massive, unchecked harmful interference to existing operations as PALs overwhelm post-transition GAA use of grandfathered operations.").

basis and licensees must share spectrum and coordinate operations."[64] And as NCTA points out, unlicensed operations, to which GAA will be closely similar, "have a proven track record of successfully protecting incumbent operations."[65]

In addition, as commenters have explained, one of the benefits of GAA spectrum is that the availability of GAA spectrum, coupled with the existing band-wide operability requirement,[66] allows PAL licensees to guarantee that their investments will never truly be "stranded" at the end of their license terms if they choose not to acquire another PAL.[67] But T-Mobile's proposal would eliminate that benefit in much of the country by precluding access to GAA spectrum in areas with significant demand for PALs. And, ironically, these would likely be the areas where GAA spectrum would be most valuable to promote certainty, since significant competition for PALs would also increase the odds of a given PAL licensee's being outbid in a future auction.

T-Mobile argues that GAA spectrum does little to promote certainty for PAL licensees, as GAA spectrum cannot provide the interference protections needed for a carrier-grade service.[68] But this argument disingenuously ignores recent developments in LTE technology and wireless business models—developments spearheaded, in many cases, by T-Mobile itself.

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64 *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, GN Docket No. 12-354, Report and Order and Second Further Notice of Proposed Rulemaking, 30 FCC Rcd. 3959 at ¶ 410 (2015).

65 NCTA Comments at 14. *See also* All Points Comments at 2.

66 47 C.F.R. § 96.39(b).

67 *See e.g.*, DSA Comments at 13; Starry, Inc. Comments at 6.

68 *Petition for Rulemaking to Maximize Deployment of 5G Technologies in the Citizens Broadband Radio Service and Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band* at 12-13, Petition for Rulemaking, GN Docket No. 12-354 (filed June 19, 2017).

Today's wireless deployments include carrier-grade LTE implementations that operate in *both* licensed and unlicensed spectrum. T-Mobile itself, during the original 3.5 GHz proceeding, met with the Commission to discuss its interest in deploying License Assisted Access LTE in 3.5 GHz GAA spectrum.[69] Likewise, Qualcomm announced that it has been "getting ready for CBRS by making multiple LTE-based solutions available: LTE-TDD, Licensed Assisted Access (LAA) and MulteFire. Each of these offers different benefits and can co-exist together in the CBRS spectrum."[70] Thus, T-Mobile and other carriers' claims that GAA spectrum will not support the types of service that would allow them to recoup their investments—even after years of exclusive PAL access—do not withstand scrutiny.

III. THE PROPOSED CHANGES WILL WEAKEN U.S. LEADERSHIP ON 5G.

There is no dispute in this proceeding that the Commission's spectrum policies, including rules governing the 3.5 GHz band, should promote the next generation of wireless technologies. As the record confirms, however, imposing rules that effectively limit access to PALs to traditional carrier deployments will undermine rather than support the goal of advancing U.S. leadership on 5G.

CTIA and T-Mobile assert that adopting rules geared to maximize auction participation by large regional or national telecommunications carriers will best promote U.S. leadership in 5G technologies.[71] But this argument presumes that 5G networks will be little more than an

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[69] Letter from Steve B. Sharkey, Chief Engineering and Technology Policy, Federal Regulatory Affairs, T-Mobile, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 12-354 (filed Mar. 13, 2015).

[70] Patrik Lundqvist, *A New Kind of Spectrum for New Opportunities*, QUALCOMM (Aug. 29, 2016), https://www.qualcomm.com/news/onq/2016/08/29/new-kind-spectrum-new-opportunities.

[71] *See* CTIA Petition at 3-6; T-Mobile Petition at 5-9.

expansion of the traditional carrier offerings that characterize previous generations of wireless technologies. As several parties have made clear, the opposite is true.

According to Ruckus, "there is general consensus across the broad wireless industry that meeting the ITU goals for 5G will require an 'umbrella' of technologies, deployers, and operators."[72] Similarly, NCTA observed that a range of wireless industry participants "have all recognized that 5G networking will rely on integrating a variety of different radio access technologies."[73] For example, a white paper by Nokia notes that "[5G] will be a combination of existing [Radio Access Technologies (RATs)] in both licensed and unlicensed bands, plus one or more novel RATs optimized for specific deployments, scenarios and use cases."[74]

This consensus "represents a significant departure from the previous 2G, 3G, and 4G iterations, in that those prior generations were specifically associated with only cellular technologies, mobile operators, and their use cases."[75] Indeed, as Casa Systems explained, while it "is undoubtedly true" that many 5G services will be provided by traditional licensed mobile operators, it is also "very possible that the majority of [5G] services will be provided by innovative, new operators, or by technologies that are deployed without the involvement of a wireless operator."[76]

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[72] *Id.*

[73] NCTA Comments at 7 (internal citations omitted).

[74] Nokia, *FutureWorks: Looking Ahead to 5G* at 3 (2014), *available at* http://www.5gamericas.org/files/3614/3898/6583/Nokia_White_Paper_-_Looking_ahead_to_5G.pdf. *See also* Ruckus Comments at 2-3 ("5G radio access technologies will include next generation 3GPP specifications (e.g. 5G New Radio 'NR'), but will also include next generation IEEE specifications (e.g. 802.11ax and 802.11ay) and most likely newer wireless technologies for specialized communications (e.g. IoT specific technologies).").

[75] Ruckus Comments at 2.

[76] Casa Systems Comments at 3.

For example, the record demonstrates that 5G networks are likely to be operated by a range of entities in addition to traditional carriers, including cable companies,[77] rural broadband providers,[78] fixed point-to-point operators,[79] private enterprises,[80] municipalities,[81] manufacturing facilities,[82] and other industries.[83] These 5G networks will have numerous potential applications, including "enhanced mobile broadband," "[w]earable devices/sensors," "[s]mart homes, buildings, and cities," "[a]utonomous vehicles and object tracking," "[i]nfrastructure monitoring and control (*e.g.,* 'Smart Grid')", and "[r]emote control and process automation,"—many of which do not require the involvement of a traditional wireless carrier.[84] In contrast, as the City of New York explains, the Petitioners' proposed changes are intended to promote only a "paltry vision of what [5G] can mean for consumers."[85]

As commenters make clear, the widespread interest in the 3.5 GHz band demonstrates that the fundamental changes to the CBRS rules sought by the Petitioners are not necessary to promote investment in 5G technologies.[86] But the record shows more than that. Because the rule changes sought by CTIA and T-Mobile are narrowly tailored to traditional carrier networks,

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77 NCTA Comments at 4.

78 WISPA Comments at 11-12.

79 Casa Systems Comments at 2.

80 Ruckus Comments at 3.

81 City of New York Comments at 2.

82 Ruckus Comments at 3.

83 *See id.*

84 Casa Systems Comments at 4 (citing Highlights of 5G and the Internet of Things, NIST Workshop on Named Data Networking, May 31 - Jun 1, 2016, by Vincent D. Park, Senior Director, Engineering, Qualcomm.).

85 City of New York Comments at 2.

86 *See* NCTA Comments at 6; Google Inc./Alphabet Access Comments at 13; Ruckus Comments at 9; Casa Systems Comments at 8-9.

they would exclude the "kinds of connected devices that will make the benefits of 5G real for consumers."[87] Thus, as Ruckus explained, "many of the requested changes in the Petitions would actually weaken our nation's leadership in 5G wireless."[88]

IV. CBRS MUST BE PROTECTED FROM HIGH-POWER ADJACENT-BAND WEATHER RADARS.

Google and Alphabet Access agree with the concerns of the Wireless Innovation Forum regarding the possible impact of high-power commercial adjacent-band weather radars on CBRS.[89] We have acquired data on one of the existing adjacent-band weather radars, and note that under a certain operating mode, the radar almost exactly replicates the signature of the principal military in-band radar that must be detected by Environmental Sensing Capability ("ESC") sensors. In addition, the five weather radars currently in the FCC's license database are authorized for radiated powers ranging from 8-12 gigawatts.[90] With even small amounts of leakage into the CBRS band, such radars can trigger ESC sensors, causing potentially widespread but unintended (and unwarranted) CBRS outages.[91]

To the extent that such radars are expected to proliferate, the FCC should take action now to mitigate negative impacts on CBRS operations. Because these weather radar systems operate on a secondary basis, the Commission should require them to utilize filters to reduce their

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87 City of New York Comments at 2.

88 Ruckus Comments at 2. *See* also City of New York Comments at 2 ("Initiating a rulemaking in response to the petitions of T-Mobile and CTIA . . . would undermine our country's global leadership in 5G.").

89 *See* Comments of the Wireless Innovation Forum, GN Docket No. 12-354 at 3-7 (filed July 24, 2017) ("WInnForum Comments").

90 *See* ULS Call Signs WNAN640, WQVR961, WQDF801, WPYY795, WPSM233.

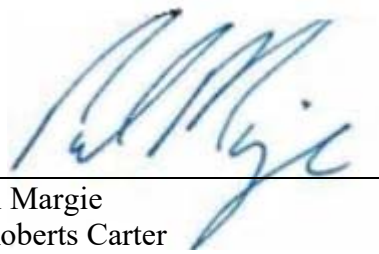
91 *See* WInnForum Comments at 5.

emissions into the CBRS band, and to operate below 3540 MHz to provide a 10 MHz guard band over which the filters can take effect. Moreover, because each potential interference case will be different, the Commission should require weather radar operators to coordinate with ESC operators prior to deployment to ensure that their intended location and operating parameters (even with filtering) will not cause interference to ESC sites.

CONCLUSION

The record overwhelmingly confirms that the current CBRS framework has promoted innovation and investment in the 3.5 GHz band, providing a foundation for a wide range of next-generation network deployments in the near future. The Commission's decision in this proceeding should reflect this consensus and reject CTIA and T-Mobile's invitations to replace the CBRS framework with rules specially tailored to support the business interests of only few entities.

Respectfully submitted,



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